

ATMOSPHERIC ELECTRICITY.

AURORAS.

The auroral display of the 2d, although not observed extensively in the United States, was probably the most important of the month. It was observed at numerous stations in the British Isles; by vessels on the Atlantic ocean; generally at stations in Canada and New England, and at a few stations in the lake region.

The following communication by Mr. W. H. M. Christie, of the Royal Observatory, Greenwich, relating to this display is taken from "Nature," of October 12, 1882:

"At 21 h. 40 m. (Greenwich mean time) on October 1st, a sudden disturbance of the magnetic declination and horizontal force commenced, and the motions were rapid, though not exceptionally large, until about 6 h. 50 m. on October 2d, when a large decrease of declination and horizontal force took place. From about 6 h. 50 m. to 7 h. 20 m., the declination diminished 1° , and the horizontal force about 1-70th part. The motions were active till 11 h., less so till 14 h. or 15 h., when the disturbance ended. There was much activity between 9 h. and 10 h.

Both earth-current traces showed a sudden commencement of disturbance at 21 h. 40 m., just as in the case of the magnetic registers, the times of greatest activity, and the time of cessation of disturbance being also coincident. As is usually the case, earth-currents were more active along the north and south line than along the east and west.

As regards the aurora, a bright arch extended along the north horizon to an altitude of 20° , from 6 h. 48 m. to 7 h. 30 m., and remarkable outbursts of streamers were noted, from 6 h. 45 m. to 7 h. 30 m., and from 9 h. 8 m. to 9 h. 25 m., corresponding closely, in point of time, with the more active parts of the magnetic disturbance. Patches of phosphorescent light were seen in various parts of the southern sky, between 7 h. and 7 h. 36 m., and ruddy light (principally near Arcturus) was observed between 6 h. 45 m. and 7 h. 30 m.

In connection with this magnetic disturbance, it is to be remarked that a large spot was on the central meridian of the sun, on September 30th, having been first seen near the east limb, on September 25th. It increased considerably in size as it passed across the disc, and its dimensions on September 30 were:—length 108"; breadth 65"; area of whole spot (in millionths of the sun's visible hemisphere,) 990; of umbra, 215. There was a line of smaller spots following it 128" in length, with an area of 520, and a spot of considerable size near the equator, forming, on October 1st, with the large spot, three spots visible to the naked eye. The large spot was nearly in the same position on the sun's surface as the great spot of last April, its heliographic longitude being 51° , and latitude 22° S., whilst the position of the great spot on April 10th, was longitude 65° , latitude 29° S.; and at its next return, longitude 52° , latitude 29° S."

The aurora was witnessed on board the s. s. "Arizona," in N. 51° , W. 28° . It was first observed at 7 p. m. (ship's time), but was most brilliant between 12.00 and 12.15 p. m. (Greenwich mean time); sheets of light resembling the folds of a curtain, passed rapidly across the northern sky. The light was colorless, with occasional flashes of crimson.

In Canada, the following stations reported the display: Fredericton and Saint John, New Brunswick; Halifax and Sydney, Nova Scotia.

The following descriptions of the display, as observed at stations in the United States have been received:

Eastport, Maine, 2d: A brilliant auroral arch of about 25° altitude, was visible from 6.55 p. m., until early morning of the 3d.

Gardiner, Maine, 2d: At 7.30 p. m. there appeared a bright auroral arch of about 10° in height, with beams below and above the arch. At 9.00 p. m. it had almost disappeared; at 11.00 p. m., although the moon shone brightly, the aurora was still visible, but the arch had disappeared, leaving only a light

which extended to an altitude of 25° . The display continued until morning of the 3d.

Burlington, Vermont, 2d: An aurora, consisting of a pale yellow light, was visible from 10.00 p. m. to midnight.

Mount Washington, New Hampshire, 2d: An auroral display, extending from northwest to northeast, was observed from 10.00 to 10.40 p. m.; it consisted of waves of a whitish color which flashed from the horizon to the zenith.

New Haven, Connecticut, 2d: A dim auroral light of brief duration was first observed at 7.20 p. m.

Block Island, Rhode Island, 2d: A faint aurora was observed from 8.40 to 10.45 p. m.

Cambridge, Massachusetts, 2d: An extensive auroral light was observed during the evening, among the clouds. At 7.45 p. m., a few faint streamers were observed. The following New England stations also report its appearance: Fall River, Rowe, and Somerset, Massachusetts; Bangor, Cornish and Orono, Maine; Auburn, and Grafton, New Hampshire and Woodstock, Vermont.

North Volney, New York, 2d: A diffuse auroral light in the north; partly obscured by clouds.

Alpena, Michigan, 2d: At 9.30 p. m. a diffuse auroral light, with a few small streamers, was observed in the northern sky. The display ended at 10.25 p. m.

Mackinac City, Michigan, 2d: Auroral light from 10.00 p. m. to 12.30 a. m. of the 3d, consisting of a few streamers, reaching an altitude of 25° .

Grand Haven, Michigan, 2d: At 8.30 p. m., an aurora, resembling the morning dawn, extended from 10° east of north to 10° west, and to an altitude of 25° .

The most widely observed display in the United States was that of the 5th. It was observed from New England westward to Wyoming and Montana, and southward to stations in northern Virginia, central Illinois, and northern Kansas.

The following are some of the most noteworthy descriptions: Eastport, Maine, 5th: At 7.00 p. m., a brilliant auroral arch of 25° altitude was observed. It was of whitish color and remained visible until the early morning of the 6th.

Bangor, Maine, 5th: Very brilliant aurora visible throughout the entire night.

Mount Washington, New Hampshire, 5th: At 10.50 p. m., an aurora was observed extending from west to east, and consisting of waves of white light which flashed rapidly from the horizon. The display ended during the early morning of the 6th.

Burlington, Vermont, 5th: From 9.00 p. m. to midnight, the display was very brilliant. It consisted of a bright well-defined arch of light; streamers shot upward to the zenith. The light extended from northwest to northeast.

Boston, Massachusetts, 5th: From 10.20 p. m. to midnight, an auroral light, reaching an altitude of 90° and covering 90° of the horizon, was visible. It was of a pale blue color with waves and streamers.

Springfield, Massachusetts, 5th: At 11.00 p. m., a pale auroral light was visible through the openings in the clouds. After midnight the color changed to crimson and became very brilliant.

Thatcher's Island, Massachusetts, 5th: The auroral display was observed from 8.45 p. m. to 1.30 a. m. of the 6th. It consisted of an arch of deep yellow color resting upon a dark base. Beams of yellowish light shot upward toward the zenith. The aurora extended from an altitude of from 25° to 60° and covered 40° of the horizon.

Atlantic City, New Jersey, 5th: From 8.45 to 11.40 p. m. an auroral light of yellowish color extended upward to an altitude of 30° , and from 30° east of north to 30° west; a few streamers, extending to an altitude of 45° , were observed.

Woodstock, Maryland, 5th: A faint aurora, consisting of an arch with a dark cloud beneath, was observed at 10.00 p. m.

Washington, District of Columbia: The aurora was first observed at 2.20 a. m. of the 6th, as an irregular arch of light extending 20° on either side of the north point of the horizon,

and having extreme height of 15° above the horizon at the centre, and from 8° to 10° broad. Beneath this was the dark segment, which, in this case, may have been stratus cloud. When noticed, at 2.20 a. m., there was a single bright streamer 20° west of north and extending 30° toward the zenith. At frequent intervals there were seen flashes of lightning at the upper edge of the dark segment, betokening possibly a storm to the northward. At 3.17 a. m., the arch brightened up and a few faint streamers were seen, having a lateral motion from east to west. The light of the waning moon undoubtedly interfered in part with the display.

Fort Myer, Virginia, 5th: From 8.30 to 11.15 p. m., bright auroral beams, reaching an altitude of 30° , were observed in the northern sky.

Rochester, New York, 5th: At 9.30 p. m., a brilliant aurora, of pale yellow color changing to bright red, was observed in the northeastern sky. It consisted of numerous slender beams, which occasionally shot upward to within a few degrees of the zenith. The display ended at 2.30 a. m., of the 6th.

Erie, Pennsylvania, 5th: At 8.40 p. m., an aurora was observed, consisting of waves of bright light flashing to the zenith. The display ended at 1.15 a. m., of the 6th.

Chicago, Illinois, 5th: At 9.15 p. m., a faint auroral glow, extending from 15° west of north to 25° east, and to an altitude of 25° , was observed in the northern horizon. At 10.30 p. m., faintly-defined streamers shot upward in the north to a height of 35° and slowly faded away. Later, an arch was formed which extended from northwest to southeast. It was apparently about the width of an ordinary rainbow but was wider at the extremities. The display ended at 11 p. m.

Dubuque, Iowa, 5th: At 8.55 p. m., an aurora was visible in the north; at 10.18 p. m., a bright band shot upward from the west with no visible connection with the light in the north. This band appeared instantaneously, passing about 10° south of the zenith and reached the horizon. It remained intact for thirty minutes, when it moved slowly southward and gradually broke up about 15° south of the zenith. The eastern part disappeared first, leaving the western end visible, which resembled an immense feathery plume. During the presence of this band, the light remained in the north, and after its disappearance, a few streamers were observed.

Northfield, Minnesota, 5th: Bright auroral arch at 11.00 p. m.

Tobacco Garden, Dakota, 5th: Aurora visible at 7.30 p. m. At 9.00 p. m., streamers and curtains of light were very brilliant. At that hour, the aurora extended over about 105° of the horizon and to an altitude of 45° ; at 9.15 p. m., it covered over 180° of the horizon and extended to the zenith.

Fort Keogh, Montana, 5th: At 8.10 p. m., an aurora of pale yellow color, was observed, extending from northwest to northeast and to an altitude of 40° . A few streamers appeared between 10.20 and 10.30 p. m., having a motion from northwest to northeast. Soon after this time, the display faded away.

Fort Benton, Montana, 5th: From 8 to 10 p. m., an aurora was observed, extending from northwest to northeast. It consisted of streamers and tremulous waves of straw-colored light.

Fort Washakie, Wyoming, 5th: At 7 p. m., a pale circular light was observed. At 8.10 p. m., a well-defined aurora was visible, which increased in brilliancy until 9.00, when beams appeared, shooting upward with a quick longitudinal movement. The display ended at 10.00 p. m.

Umatilla, Oregon, 5th: At 7.30 p. m., an aurora was observed, consisting of slender luminous beams, reaching an altitude of 15° . It was most brilliant from 7.50 to 8.50 p. m., after which time it faded away somewhat, but it was reported to be very brilliant between 1.00 and 2.00 a. m., of the 6th. The display continued until 5 a. m.

There were other displays, of less extent and brilliancy, during the month. They occurred on the following dates: 3d, 4th, 6th, 8th, 10th, 11th, 12th, 14th, 15th, 16th, 22d, 23d. The most noteworthy of these was the display of the 4th, which was observed at stations east of the eighty-second meridian to the Atlantic, and as far south as Kittyhawk, North Carolina.

Professor C. Carpmal, superintendent of the meteorological service of the Dominion of Canada, reports auroral displays, which were not observed in the United States, on the following dates: 9th, 21st, 27th 28th.

THUNDER-STORMS.

Thunder-storms were reported in the various districts on the following dates:

Middle Atlantic states: 23d, 24th, 27th, 28th.

South Atlantic states: 10th, 11th, 20th, 23d, 28th to 31st.

Florida peninsula: 1st, 3d, 7th, 8th, 9th, 13th, 31st.

East Gulf states: 1st, 7th, 8th, 12th, 13th, 18th, 29th, 30th, 31st.

West Gulf states: 1st, 5th to 9th, 12th to 16th, 18th, 28th, 29th.

Rio Grande valley: 3d, 5th, 8th, 15th.

Ohio valley and Tennessee: 1st, 2d, 3d, 7th, 8th, 12th, 13th, 27th to 31st.

Lower lake region: 5th, 9th, 13th, 27th to 31st.

Upper lake region: 3d to 7th, 9th, 12th, 13th, 20th, 28th, 30th.

Extreme northwest: 1st, 3d to 6th.

Upper Mississippi valley: 1st to 8th, 11th, 12th, 13th, 15th, 26th, 27th, 28th, 30th, 31st.

Missouri valley: 1st to 12th, 14th, 15th, 16th, 27th, 28th, 30th, 31st.

Northern slope: 1st to 5th, 9th, 11th.

Middle slope: 2d to 7th, 9th, 11th, 12th, 15th, 16th, 27th, 28th, 30th, 31st.

Southern slope: 2d to 7th, 10th 15th, 16th.

Thunder-storms were also reported from the following stations not included in the districts named above: Coalville, Utah, 2d; Tucson, Arizona, 3d; Santa Fé, New Mexico, 1st; Colfax, Washington Territory, 15th; Red Bluff, California, 1st; Portland, Oregon, 10th.

The following instances of damage by lightning during thunder-storms have been reported:

Mobile, Alabama, 31st: A flag staff, used for the display of storm signals, was struck by lightning and demolished.

Port Eads, Louisiana, 1st: At a 2.00 a. m., during a heavy rain and thunder storm, the carpenter shop of the Jetty company was struck by lightning and burned, entailing a loss of from \$6,000 to \$7,000.

Logansport, Indiana, 28th: A building near the Signal office, was struck and damaged by lightning.

Springfield, Illinois, 28th: Building struck and damaged by lightning.

Wicklow, Dakota, 11th: A house was struck and injured by lightning.

Fallsington, Pennsylvania, 27th: During a thunder-storm at Yardleyville, near this place, a barn was struck by lightning and burned, in which were eight cows, four horses, crops and farming implements, all of which were destroyed.

Pierce City, Missouri, 29th: During the storm last night, the lightning struck a barn, four miles from here, killing one man and four horses.

Hagerstown, Ohio, 31st: A barn near here was struck by lightning during a thunder storm and totally destroyed. Loss about \$2,000.

OPTICAL PHENOMENA.

SOLAR HALOS.

Solar halos have been observed in the various districts, on the following dates:

New England: 2d, 9th, 15th, 20th, 21st, 27th, 30th.

South Atlantic states: 1st, 3d, 8th, 10th.

Ohio valley and Tennessee: 1st, 2d, 3d, 5th, 7th, 13th, 18th, 25th, 26th, 28th.

Lower lake region: 13th, 22d, 25th, 26th.

Upper lake region: 2d, 18th, 20th, 21st, 23d, 25th, 26th.

Upper Mississippi valley: 1st, 4th to 7th, 14th, 18th, 21st, 24th to 27th.

Missouri valley: 4th, 5th, 18th to 22d, 25th, 26th.